Dose-Response Evaluation of Braslet-M Occlusion Cuffs

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Introduction: Braslet-M is a set of special elasticized thigh cuffs used by the Russian space agency to reduce the effects of the head-ward fluid shift during early adaptation to microgravity by sequestering fluid in the lower extremities. Currently, no imaging modalities are used in the calibration of the device, and the pressure required to produce a predictable physiological response is unknown. This investigation intends to relate the pressure exerted by the cuffs to the extent of fluid redistribution and commensurate physiological effects.

Materials and Methods: Ten healthy subjects with standardized fluid intake participated in the study. Data collection included femoral and internal jugular vein imaging in two orthogonal planes, pulsed Doppler of cervical and femoral vessels and middle cerebral artery, optic nerve imaging, and echocardiography. Braslet-M cuff pressure was monitored at the skin interface using pre-calibrated pressure sensors. Using 6° and 30° head-down tilt in two separate sessions, the effect of Braslet-M was assessed while incrementally tightening the cuffs. Cuffs were then simultaneously released to document the resulting hemodynamic change.

Results: Preliminary analysis shows correlation between physical pressure exerted by the Braslet-M device and several parameters such as jugular and femoral vein cross-sections, resistivity of the lower extremity vascular bed, and others. A number of parameters reflect blood redistribution and will be used to determine the "therapeutic range" of the device and to prevent unsafe application.

Conclusion: Braslet-M exerts a physical effect that can be measured and correlated with many changes in central and peripheral hemodynamics. Analysis of the full data set will be required to make definitive recommendations regarding the range of safe therapeutic application. Objective data and subjective responses suggest that a safer and equally effective use of Braslet can be achieved when compared with the current non-imaging calibration techniques.